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FROM SEED TO SPINDLE.

IT is well recognised by most thoughtful people that the principle of continuity is all-pervading, that there is no such thing as an end to anything, that what we call an end is simply a change into something else. When a plant dies it merely means that chemical decomposition takes the place of chemical synthesis; but this decomposition itself becomes synthetic since it gives rise to carbon dioxide and humus which furnish some of the raw materials for new generations. In Nature, generally, time and ether are the two most striking elements of continuity, but we also see it in the structure of the atom and especially in the science of mathematics. Cartesian Geometry or what is more popularly known as "graphs" is fundamentally universal and continuous. The axes so frequently shown in text books as a closed frame, really belong and are part of the four quadrants of the Universe from whose centre or origin 0, we may proceed to infinity at whatever angle and in whatever plane we please. By means of plotting points we can show that the same "science" underlies such apparently different subjects as surveying, economics, physics, heredity, physiology, accountancy and even gambling: that in mathematics the slope of a straight line to these axes is fundamental in explaining and co-ordinating the calculus, trigonometry, correlation, solid geometry and equations. This being the case, it is hardly possible to avoid looking for continuity or rather to avoid seeking to describe continuity in industry. Most people know that it exists. British miners for example produce coal for steamships and manufacturing industry; the steamships take away the manufactures and bring back food which the miners buy with the money they have secured from the sale of their coal. An infinite number of these cycles both large and small could be cited. Yet few of these will be found to possess more than a general economic continuity; that is they are devoid of a continuity of definite industrial interest and technical interdependence. Great exceptions to this are to be observed, however, in certain manufacturing industries and trades which absorb the products of tropical agriculture. Cotton affords the most striking example of industrial continuity or perhaps it would be truer to say the need for it. On account of the fact that the spinning of cotton is intimately connected with the characters of cotton lint, technical continuity in respect of growers of cotton and the users is essential. Further, since an adequate and regular supply of cotton at a reasonable cost is also necessary, it is clear that cotton growing and cotton spinning are to be regarded as one industry commercially, that the success of the cotton industry in say Lancashire ultimately depends upon success at the growing end and *vice versa*. Scientific workers at both extremes must be in intimate contact; there must also be commercial activity in the interest of the spinners in order to maintain consumption. New designs, textures and advertising are just as much the concern of the growers as of the manufacturers, for unless the continuity in the cycle of production and consumption is maintained everyone suffers in the long run. This is now well realised, and one of the most striking manifestations of that realisation is the advent of the Cess idea. In England the majority of spinners have voluntarily submitted to legislation which enforces a special tax on every bale of cotton imported in order to provide funds for the expansion of cotton production within the Empire. In India a similar Cess is in existence for providing funds for the Indian Central Cotton Committee the activities of which were described in the last issue of this Journal. These examples of

self-support and combination are notable testimonials to the point of view that cotton growing and cotton spinning are really one industry. The same idea is to be seen existing in other industries too. Tea affords a striking example. This produce does not enter into manufacture in the industrial sense: blending and selling are the problems, more so than they are in the case of cotton, for cloth is a physical necessity, whereas tea is not. The demand for tea is essentially psychological, and it is in connection with the demand or marketing end that the Indian growers, who produce nearly half the world's supply, find themselves forced to act by means of advertising. The Indian tea Cess has for years provided money for stimulating demand in this way, and the recent activities in the United States constitute one of the most striking advertising campaigns ever known. We have mentioned that tea does not enter into industrial manufactures; it does enter into manufacture in a sense, however, namely, in the household kitchen, and an interesting and important feature of the campaign in the United States is the great attention that is being given to a description of the proper way of making tea, ignorance of which is recognised now as a reason for the low consumption in America. This campaign is entirely financed and initiated by the Indian growers, in other words by tropical agriculture, and the restriction and "new uses" programme of the Eastern rubber industry, Government control in the Brazilian coffee industry are all of a similar character. They indicate that tea growing and tea drinking, coffee growing and coffee drinking, cotton growing and cotton spinning, rubber growing and rubber consumption is each respectively part of a single industry. One of the aims of the Institute of the Rubber Industry is to effect this continuity as is evidenced by its crest composed of a tree of Hevea with rubber-goods factories in the background. It makes tropical agriculture a very much wider and more interesting subject to study than if there were not this close economic connection with growers and markets, and no College of tropical agriculture can afford to fail to give it close consideration. The continuity provides more scope for advancement too, for if each industry is to be continuous, it opens up many more intermediate positions that the worker at the production of raw material end need no longer feel that he is relegated to the jungle to be a hewer of wood and drawer of water. He can if he cares advance in the direction of commerce and administration or industrial technology and science: what Professor Harland calls "pursuing the raw material." In any case the planter of to-day in most tropical industries is no longer a disconnected unit. He is part of a vast industrial organization. In gauging its dimensions and characteristics he must, however fully realise that within each economic trading cycle there exists competition, for instance, Java tea and rubber in competition with Ceylon tea and rubber. There are teas and teas, cottons and cottons, and where the grades differ greatly each industry really divides up into kinds of species of a genus. This, however, does not lessen but rather accentuates the existence of continuity and system between the grower of raw material and the ultimate consumer which is so extremely pronounced and so exceedingly important in the case of cotton.

SUGAR RESEARCH.

R. G. W. Farnell, A.I.C.,
(*Chemist, British Empire Sugar Research Association.*)

[*The components of sugar-cane juice which give most trouble to the sugar manufacturer, are substances of a slimy non-crystalline nature, that are difficult to filter, and effective in discolouring and in retarding the crystallization of sucrose. They are termed colloids. Familiar examples are the proteins (which include white of egg and gelatine), starch, soap, gums, tannins and many dyestuffs. Mr. Farnell deals with certain colloids in relation to sugar manufacture, in the following paper.*]

The importance of the colloids of the cane in relation to the manufacture of sugar has of late been recognised. The clarification of cane juice is essentially the elimination of certain substances of the emulsoid type of colloid. Yet little research has hitherto been attempted in order to find out exactly what are the colloids of the cane. Preliminary investigations conducted recently at the Imperial College of Tropical Agriculture have shown the following colloidal substances to be present in juice extracted from cane by crushing in a mill: (1) Protein (principally albumen); (2) Pentosan (one of the constituents of "cane gum"); (3) Pectin (like the pentosan derived from the fibre); (4) Tannin; (5) Cane wax; (6) Silica (derived partly from clay adhering to the canes, partly from the juice itself).

Let us first examine the general effects of these colloids in sugar manufacture. On concentration emulsoids become progressively hydrated and form viscous solutions. The rate of boiling of sugar syrups and "massecuites" (a mixture of crystals and molasses) depends partly on the viscosity, a more viscous massecuite evaporating much more slowly. Now in a sugar factory it is very important to avoid letting the mill get ahead of the boiling house, *i.e.*, producing more juice than can be concentrated in the evaporators and vacuum pans. If massecuites boil slowly, owing to their high viscosity, it is necessary to discharge them from the pan before attaining the density proper for their economic exhaustion. This means a loss of crystallisable sugar: not only due to a low "coefficient of supersaturation" already explained, but also due to the stabilising effect of the colloids, since they hold in solution sucrose that would otherwise crystallise out.

Let us next take the importance of colloids in connection with the colour of cane products, obviously a prime factor where the manufacture

of a light, or white sugar is desired. Most of the colour is developed in manufacture, for juice expressed in an enamelled "tincture press" has a light grey colour, whereas factory juices, syrups, and molasses are very dark, in fact almost black. Zerban working in Louisiana has recently shown that the chief cause of this dark colour is a ferric compound of a poly-phenol, *i.e.*, cane tannin. Prior to the introduction of aniline dyes ferric tannate was manufactured expressly for making ink, which was merely a dilute solution of this substance. Since it will never be possible to eliminate iron from cane juices as long as canes are crushed in iron mills, we cannot hope to avoid the formation of ferric tannate. So attention must be devoted to eliminating this substance after it has been formed, or else to diminishing the colour by reducing the iron to the ferrous condition.

Now tannin as already mentioned is colloidal, and without entering deeply into the difficult and involved question of adsorption it may be stated that colloids and any substances which lower the surface tension of water tend to concentrate at an "interface" *i.e.*, at the surface of the liquid, or else on the surface of a solid, if there be any solid substance present in the liquid. This property of colloids has for generations been unwittingly employed for their removal. In the sugar industry we need only concern ourselves with the use of "bone char" or animal charcoal, for removing colour from raw sugar solutions and the more recent introduction of the sulphitation and carbonatation processes for making "plantation whites" direct from the juice. In the operation of the bone char refinery the dark colour of the raw sugar solution is adsorbed at the surface of the char. The greater the "specific surface" the more active will be the carbon in adsorbing the colloids and this has led to the introduction of artificial vegetable carbons possessing a much higher specific surface than animal charcoal. The use of these carbons is slowly extending both in refineries and also in the raw sugar industry where they are principally used on syrups.

The essential point of the sulphitation and carbonatation processes is the production in the juice of a crystalline precipitate of calcium sulphite and carbonate, respectively, by the action of either sulphur dioxide or carbon dioxide on a suspension of lime, previously or simultaneously added to the juice. At the surface of these precipitates are adsorbed some of the colloids, the amount depending on total surface and also, among other factors on the reaction (hydrogen-ion concentration) of the juice. The sulphur dioxide reduces the iron in the juice to the ferrous condition, and ferrous tannate is much lighter than the ferric compound. However on oxidation the colour reappears and it is generally admitted that sulphitation sugars are not quite as permanently white as either carbonatation or refined sugars.

Besides colour, another source of trouble in the factory are certain precipitates which often appear after the concentration of juice to syrup. These precipitates do not subside readily and unless the syrup is filtered the resulting sugar has a dim appearance and furthermore may not "cure" well in the centrifugal. It appears that these syrup precipitates contain a large proportion of silica, partly derived from clay adhering to the cane, partly from the juice itself, in which it is both in mineral, and organic (colloidal) combination. Experiments in Louisiana and Demerara have shown that by washing the cane on the carrier before entering the mill there is a diminution of the siliceous syrup precipitate. With regard to the colloidal organic silica, Muller, in Egypt, has shown that its decomposition occurs if the raw juice is heated to a high temperature (116° C) before liming. Muller's experience has been confirmed by Bird, in Demerara, who obtained a cleaner sugar, and a higher recovery by heating raw juice before liming. This higher recovery prompted the author to investigate the subject under careful laboratory conditions and he found that heating raw juice at its natural acidity coagulated much more albumen than heating the juice after neutralising with lime. Both from the point of view of colloidal silica and albumen it seems beneficial to lime the juice after heating, instead of before, the usual practice.

The pectin and pentosan (mentioned at the beginning) are derived from the cane fibre and are somewhat similar bodies, differing however in one important point. Pectin in alkaline solution is converted to pectic acid, the calcium salt of which is insoluble. This does not occur with the pentosan which is the principal constituent of cane gum. On adding lime to the juice till alkaline, calcium pectate is formed. However an "alkaline clarification" is not always desirable since there is a risk, when heating, of decomposing part of the glucose into dark coloured products. Furthermore the rate of settling, and volume of "muds" (principally fibre and coagulated albumen) depend on the reaction of the juice. The muds are of far greater volume and settle much slower in alkaline than in neutral juice, and unless there is ample settling capacity it is wise, perhaps, not to attempt to precipitate the pectin by alkaline clarification. In the carbonatation and sulphitation processes, where a large excess of lime is added to the cold juice and afterwards neutralised, the pectin is of course precipitated, and the pentosan partly removed by adsorption which does not occur in the ordinary "Defecation" process. (Adding lime to neutrality and heating.)

The cane wax, which occurs on the surface of the cane stem round the nodes, escapes into the juice on milling especially if hot maceration water is used which melts it. The wax appears to form an emulsion, part of which is removed in the filter press cake, part going through manufacture, being found in the final molasses. By thorough straining of the cold juice either by screening or by the more drastic centrifugal separator of Mauss, the wax, clay, and particles of megass (fibre) can be practically eliminated. This, of course, is very desirable

from the colloidal point of view, and for the production of a cleaner, brighter sugar, but on the other hand the fibre particles produce an excellent natural filtering medium for the "muds," and if removed it may be necessary to use some other filtering medium such as kieselguhr.

We know nothing of the effect of environment on the colloids of the cane, and it is possible that marked progress will be made by geneticist, plant physiologist, and biochemist in elucidating many of the problems concerned.

Enough has now been said to convey some idea of the importance of colloids in the manufacture of cane sugar, a subject of fundamental importance to the sugar industry and a subject which has been placed foremost in the programme of the British Empire Sugar Research Association.

REQUIREMENTS FOR SUGAR PRODUCTION.

SIR FRANCIS WATTS, K.C.M.G., D.SC.

In the telegraphic report of Mr. Philip Snowden's speech in the House of Commons on May 6, he is reported to have said, *inter alia*, that the Empire production of sugar had increased only 100,000 tons under five years of protection, and that in the West Indies production fell from 191,000 tons in 1919 to 159,000 tons in 1923. While these figures in themselves may be correct it would seem that one may question what they are intended to imply. Presumably the implication is that beneficial measures should be expected to produce fairly quick results in the case of sugar production and that if these results do not follow rapidly then the measures are either useless or misapplied.

Without entering into the political aspects of the case I think it is probable that the question of the response of sugar output to circumstances possesses features with which the British public are not fully acquainted. In the case of wheat-growing an extension of area and of output might be expected to follow speedily upon the advent of favourable circumstances. But in regard to sugar the case is entirely different. Sugar production differs essentially from northern agriculture in that it is not merely an agricultural industry but essentially a manufacturing one also. This manufacturing side imposes heavy restrictions in that the machinery required for sugar making is very heavy, extremely costly and requires expensive and highly technical supervision. During the last twenty-five years there has been a steady evolution in the West Indies and in other sugar-growing countries from the small plantation basis with its simple and inefficient muscovado sugar-making plant, to central factories of very large capacities. The reason for this has been that efficient extraction is only possible with heavy, multiple mills. In the West Indies this evolution has produced profound economic changes the result from a technical point of view being that now a ton of sugar can be produced from about nine tons of sugar cane, whereas with the old fashioned small mills thirteen or fourteen tons of sugar cane were required. But this development has had the effect of making it necessary to ensure the successful operation of the larger factory over a long period of years, a condition which precludes rapid changes; interdependence between field and factory over a long period is essential, as is also a stabilised market.

The necessity of producing under modern conditions sugar on a central factory basis has automatically caused those places which cannot adopt large scale methods to decline and even disappear as sugar-producing countries. This has actually occurred in the case of certain of the West Indian Islands like Dominica and Montserrat which on account of their mountainous topography and other reasons have been unable to organise and plan the production of sugar on a central factory basis.

It is quite possible that in this struggle for existence that there may have been some diminution of total output of sugar in the case of the West Indies. Figures show indeed that some of the smaller islands falling out has caused a loss of some 18,000 tons. On the other hand it must be remembered that the economic basis of production has been greatly improved and stabilised in other colonies and has conferred far greater benefit than if there had been merely increased output as the result of a large and scattered acreage under cultivation.

This change in the direction of efficiency has been accompanied by the expenditure of very large sums of money on British sugar machinery, and it is to a very great extent only by means of such investments that the sugar industry can expand in the British Empire. Another point to bear in mind in connection with Mr. Snowden's interpretation, is that sugar production varies greatly from season to season on account of varying rainfall; periods of law rainfall amounting to actual drought are not uncommon. It is not adequate for statistical purposes to judge production over a small period of time and careful consideration must in any case be given to climatic conditions and the possible incidence of pests and diseases. A more suitable standard than output would be perhaps the acreage under cultivation. But here again there is striking contrast between the cane-farmer and the farmer in England who can with reasonable facility vary the relative acreage under different crops from year to year. In the cultivation of sugar cane the process is perennial rather than annual, the plants being allowed to spring again after cutting, thus yielding successive crops with gradually diminishing returns, known as ratoons. This entails contracts between planters and factory and the whole circumstances of sugar production are such that it is only by the most careful study of the circumstances underlying changes indicated by trade statistics that we can arrive at a rational explanation of their numerical significance.

THE PRODUCTION OF PINEAPPLES.

Not least among the many romances of tropical plant industry has been the rise of pineapple production. A native of central America, the pineapple has been widely distributed and is now to be found under cultivation on a large scale in Florida, Cuba, Porto Rico, Straits Settlement, Queensland, India, the Azores, South Africa and especially in the islands of Hawaii. It is this last-named territory which offers the most remarkable picture of the phenomenal development under highly organised conditions of a new industry. From a small beginning some twenty years ago the Hawaiian islands have now become the principal source of pineapples. In 1903 the output was only 1,893 cases, in 1912 it was 1,300,000 cases, in 1921 it was 6,000,000 cases, and it is predicted that in 1925 it will be 10,000,000 and that the world's demand will be from 15,000,000 to 20,000,000 cases. Thus those in a position to judge do not look forward to over-production especially in view of the effectiveness of modern educational advertising and the prospects of better conditions in Europe more especially in France and Russia.

The remarkable development in Hawaii, and to a less extent in Florida, Cuba and the Azores, has naturally interested many tropical places which at present do not produce pineapples but where a profitable additional crop is needed. An example of such territory is to be seen in the Lesser Antilles, where, for some considerable time a great deal of thought and discussion has been devoted to the practical possibility of starting pineapple production on organised lines, that is sufficiently well organised in order to permit British West Indian fruit becoming a tributary, even if merely a minute tributary of the great trade-current of merchantable pineapples. There must be many other tropical countries gazing with rather longing eyes upon the vast and profitable developments in Hawaii, and in consequence it is probable that a brief account of the requirements and difficulties for the successful establishment of a pineapple industry may not be unacceptable to many readers of this Journal.

Without looking on the black side, we may usefully consider the causes of two instances of failure in regard to pineapple production in order to obtain information likely to be of value in making a programme of development in any new country. The first instance is that of Florida. Although this State has now revived its pineapple industry, the industry suffered almost complete extinction a few years ago. The causes of failure appear to have been two: the exhaustion of the soil humus and the disease known as the wilt or the red wilt, associated with a parasite known as the root nematode or worm. It would appear that soil depletion weakened pineapples in Florida to such an extent that they became unable to resist the nematode which appears to be widely distributed. The important point is that given proper cultivation and adequate manuring varieties of pineapples can be successfully grown in spite of the nematode; and further, areas which are badly infested by this worm can be freed by growing for two or three years crops like Natal grass and certain varieties of cow peas, on the roots of which the nematodes are unable to live and thereby become starved out.

The foregoing refers principally to the failure, or rather set-back in Florida. We will now consider a set back which occurred some years ago in Trinidad. At that time a small area was under pineapples in the south of the island and in conjunction with it a small canning factory operated. The trouble here was not the production of the fruit but inadequate experience and unfavourable circumstances in regard to the canning and distribution. In this particular case the canned fruit had to be sent to the United States where the duty against syrup in which the fruit has to be packed precluded the use of this saccharine product in the Trinidad concern. The pines were packed in tins raw with the inevitable result that those which did not pass immediately into consumption fermented and caused an acid reaction on the metal of the container which eventually resulted in the explosion of many of these hermetically sealed vessels.

In general it can be truthfully laid down that the distributive end of pineapple production makes greater claims upon knowledge, organization and capital than the production of the fruit itself. Pineapples from Cuba and Porto Rico are sent to the United States in a fresh condition principally, and without cold storage, for owing to the more northerly climate the fruit can easily stand a five or six days' journey. Fresh fruit shipped from a point so far south as Trinidad would require cold storage and this in turn would need the interest of the shipping companies. Another matter, in the case of fresh fruit, is the crating. Standardised crating is essential, and this has been realised in the West Indian island of Antigua which has developed a small fresh pineapple industry. Canadian importers have informed producers in Antigua that business is out of the question without standardised crating and uniformity of grade in the fruit itself. In order to meet the demands of the trade the Antigua producers have been able to amalgamate with the Onion Growers who have a central depot for the grading, crating and marketing of this vegetable, which can easily be extended to include pineapples.

In regard to the more positive aspect of things, it may be safely claimed that the success in Hawaii is due to mass production, intelligent propaganda and advertising and to the confidence of capitalists in the industry. It also has to be borne in mind that Hawaii has an enormous and safe market in the United States and has also established itself as the principal suppliers for Europe. For new beginners, the point to decide is the minimum production that will pay and constitute a stable

local industry. This can only be determined by information obtained from people having had actual experience in the business, and the Trinidad Chamber of Commerce, which has taken up the question of pineapple production is proceeding wisely in this direction. An even more satisfactory feature is that interest in Trinidad pineapple development has come from outside of the Colony which makes prospects very much more promising and hopeful.

In concluding these notes it may be of interest to inform readers that certain varieties of pineapples are better than others and certain varieties more suitable for market as fresh fruits on account of their appearance and shipping qualities. Other varieties are more suitable for canning. The Red Spanish is perhaps the best variety for shipping as fresh fruit. It is the variety that is mostly grown in Cuba, Porto Rico and Florida. It is hardy, it ships well and it is suited to the requirements of the American and Canadian markets. In Cuba and Porto Rico the Cabezona is grown for local use and canning. It is a large attractive fruit and a heavy yielder but it does not stand shipping well. Specially adapted for canning is the Smooth Cayenne and this is the variety grown most in Hawaii. The Hawaiian pineapple brings the best price on the market on account of superior quality. The Sugar Loaf is grown in Cuba for local use and it is being tried in Jamaica in the hope that it will prove more valuable than the varieties formerly cultivated.

As to whether to specialise in shipping canned or fresh fruit depends upon a number of circumstances which will be evident from the information put forward in this article. What may be called perhaps the normal aim in the initial stages in a place like Trinidad would be to ship most of the fruit canned, a certain choice selection as fresh fruit at suitable times, the marketing of fresh fruit locally and perhaps the manufacture of a small quantity of pineapple jam for local consumption and export say to the United Kingdom.

DETAILS OF HAWAIIAN METHODS OF CANNING.—Supplementary to the foregoing information, Major D. E. Evans, D.S.O., M.I.M.E., describes from first-hand observation in a recent number of the "Queensland Agricultural Journal" the cultivation and manufacture of pineapples in Hawaii in some detail. After describing the labour-saving machinery for cultivation, including the paper-laying machine which uses paper made from the megass of the sugar factories to conserve water and suppress weeds, Major Evans gives the canning methods.

I had the opportunity [he states] of inspecting the Queensland Government Cannery when they installed modern pineapple machinery in the form of Ginaco machines about the end of 1918, and I was naturally interested to see the development since that date in Hawaii. I visited the Baldwin Packing Company's cannery at Lahnia, on the island of Mani, and the Californian Packing Company, Honolulu. Both these canneries are fitted with Ginaco machines. The latter place has nineteen on one floor with an output of approximately 2,500,000 cases of canned pines per year. Many improvements have been made on the machinery as installed at the State Cannery, and these could be easily fitted if royalties on patents can be arranged.

The pines are taken from cases at landing stages and placed on the Ginaco machine conveyor. The conveyor elevates the pines to the machine, where they are skinned and cored in one operation, and then fall on a travelling rubber belt. Any pines that need trimming on the ends, due to any peculiar shape of the fruit, are touched up on a special cutter running at a speed of 1,800 revolutions per minute (this machine has been responsible for saving at least two hands per machine), and further hand trimming is attended to while the fruit is travelling along to the slicing machine. After slicing, the fruit travels along a ribbed rubber belt. The ribbing allows of the pine slices being easily lifted for placing in the tins.

The term agreed upon by canners for broken slices and good whole pieces of pineapple is "crush." These large pieces of broken pineapple are put through a mincer, canned, and treated separately and is largely used for salads, pies, &c. Supply is only about 75 per cent. of the demand for this product.

Jam is made from the pineapple fruit scraped from the skins in a machine called a skin eradicator. In the installation, as arranged by the California Packing Company, the skins are automatically fed into the Fisher Patent Eradicator with the Opperman Patent attachment. After the fruit is separated from the skin the fruit passes along the conveyor to brass jam pumps, and thence to boiling pots. The skins pass to the conveyor on to grinding mill.

The skins are then treated in a similar manner to sugar-cane. Methods differ slightly in various factories, but the ultimate objective is the same—the conservation of all juice and the manufacture of syrup.

The skins are passed through shredders, rollers, or, in the case of the Baldwin Packing Company, a worm press similar to a grape-press.

The extracted juice is then pumped to liming tanks and neutralizer. After treatment by liming it is pumped to a heater and elevated storage tanks. Clarification and filtration, similar to sugar-mill practice, is carried out, and finally the pineapple juice, in the form of a golden fluid, is run into storage tanks for supply to pineapple being canned.

One gallon of juice treated as above is equal to 1 lb. of sugar, and it is claimed that the pineapple takes a better colour and flavour than when treated with ordinary sugar syrup.

Some of the canneries evaporate a certain amount of water from the juice while others claim the evaporated syrup darkens the pineapple, while the original clarified juice gives the true golden colour.

Big projects are in hand for extending the industry in Hawaii and for increasing supplies. Included in the lands of Upper Hoolehua and Palaau, connected with the proposed Waihanau water development project, are some 4,000 acres of the best pineapple land in the territory, and conferences between the Hawaiian Homes Commission and local pineapple people brought out the fact that a settler, assisted by his wife and three children, can take care of approximately 30 acres of pineapples, after the land has been ploughed and the fruit planted. It is only at harvesting time that they would need outside help. Provided the settler is successful he can clear 1,000 dollars an acre in a four-year period, or 30,000 dollars from 30 acres in four years, or 7,500 dollars a year. Evidently it is intended to extend in Hawaii on this family settlement basis.

Taking everything into consideration, we think that new countries which hope to start producing pineapple products will do wisely to reflect first, if entering into the business entails direct competition with Hawaii.

PINEAPPLES IN HAITI.—From information received from the American Chamber of Commerce it would appear that the pineapple industry may develop in Haiti. The lighter type of soils are stated to be the best and it is desirable, especially in growing for the canning industry that the rainfall should be so distributed as not to interfere with harvesting during the late spring or early summer months. Very favourable rainfall conditions and soil are found in many parts of Haiti where little intensive cultivation has been undertaken for over 100 years, and extremely fertile lands, perhaps richer than any available pineapple soils in the world are procurable for lease or purchase at reasonable prices. Several varieties of pineapples are found in many districts in Haiti. Little cultivation is practised and as a rule the pineapples are found in small patches generally mixed with other food crops.

The most common variety in Haiti is the "Pain Sucre" of the type of the "Pan de Azucar" of the Spanish West Indies, pleasing to the taste but except for local consumption of no commercial importance. The "Ananas Cadiou" another variety found in many districts closely resembles the "Red Spanish" which is exported in large quantities from Cuba and Porto Rico to the United States. This pineapple could be grown commercially and exported to the United States in competition with the other West Indian pineapples. Other varieties of minor importance are scattered throughout the Republic, and in the Dominican Republic many varieties are found.

There seems to be no reason why commercial varieties of pineapples could not be grown successfully in Haiti and shipped fresh to the United States and Canada. The fact that so many varieties of pineapples now grown in Haiti in spite of an almost total lack of intelligent care, indicate that an important industry can be built up.

REVIEWS.

THE CACAO AND CHOCOLATE INDUSTRY: By Arthur W. Knapp, B.Sc., F.I.C., London: *Sir Isaac Pitman & Sons Ltd.* 1924. Price 3*s.* net.

This book is one of a series on common commodities and industries and as a brief and popular introduction to the subject of cacao from the point of view of its history, cultivation, commerce and manufacture can be safely recommended. The chapters on the manufacture of cacao and chocolate should interest the planter, while those on the growing aspects will provide the commercial student in northern countries with educative information. The treatment of the agricultural cost of production, however (Chapter VIII), is perfunctory and unstatistical; while the author's omission to give figures or information as to the manufacturing costs of cocoa and chocolate prompts the query as to why costs at one end of the industry should be given and not at the other. There is too much of this lopsidedness in books like the present one, which purport to deal indiscriminately both with the production of the raw material and its manufacture.

W. R. D.

DAIRY FARMING PROJECTS: By Professor C.E. Ladd, Ph.D. Cornell University. New York and London: *The Macmillan Co.* 1924. Price 7*s.* 6*d.* net.

Students desirous of taking up dairy farming as a business career will find this book stimulating. As the title implies, each section provides for some activity, something for the pupil to do. The book is not merely an attempt at producing a long text to be memorized. Accordingly it should arouse thought and initiative, not only in teacher and student, but also in the practical dairyman who will find this little volume replete with many valuable suggestions. A calendar with seasonal programme is included, and useful references given to the best known authors on breeding and management in the discussion on the various projects. We welcome the book and highly commend it to all interested in dairy farming.

J. S. D.

An Agricultural College differs from a purely academic institution in that it must take into account the world as it is, and not merely the world as it might, or ought to be. In contradistinction to the University, an Agricultural College has, or should have, an industrial, social almost an organic connection with certain well-defined fields of human activity, and experience has shown in most developed countries that the success of Agricultural Colleges very largely depends upon the solidarity of this connection, upon the extent to which the College really enters into the life and work of the agricultural communities it is designed to serve. But before this connection can be established there must exist both within the College and amongst the external communities a sufficiently well-developed standard of general education, or at all events, of actively intelligent interest.

TROPICAL WORLD.

BRITISH HONDURAS.

It is gratifying to learn of the progress which has been so quickly achieved in regard to forestry development and conservation in this Colony under the direction of Mr. C. Hummel who was appointed Conservator of Forests in 1921. As well as introducing economic forest policies in respect of production, Mr. Hummel has, by means of visits and advertising, accomplished a large amount of valuable work in the United States where he has demonstrated the great value and utility of many local timbers hitherto unrecognised commercially. After more than a century of wasteful exploitation the forest industry of British Honduras now appears to be running along lines comparable with those in existence in India and other places. As an example of what has been achieved in respect of transportation—an extremely important factor in forestry—it may be mentioned that the Forestry Department reduced the haulage distance from a certain area from as much as 35 miles down to 4½ miles. In addition to forestry it would appear that there are some prospects of the United Fruit Company reviving and extending their activities in the production of bananas on tracts of land in the south of the Colony, and the work which is now being done at the Imperial College of Tropical Agriculture in respect of disease-resistant varieties may at no distant date prove of considerable economic value to our only Colony in Central America.

CEYLON.

In connection with the suggested establishment of a University of Ceylon, a matter which the Colonial Secretary (the Hon. C. Clementi, C.M.G., formerly Government Secretary, British Guiana) has been advocating for some time, the Legislative Council has now definitely voted three million rupees as the basis of a Building and Equipment Fund. Concerning labour in Ceylon the report of the Planters' Association for last year indicates that the position in the island is very satisfactory from all points of view. Administrative reform in regard to labour has included the abolition of Discharge Tickets and that objectionable Cash Inducement system which included the payment of travelling expenses to coolies journeying from one estate to another. Under the new Labour Ordinance employers of Tamil labour must pay a quarterly assessment to the Government which in turn pays the passage expenses of Indian labour to Ceylon and provides for their arriving debt free. Higher wages, improved living accommodation and the fact that the labourer is landed in the Colony free of debt have all tended to popularise the island in Southern India. In regard to the subject of the improvement of tropical cattle referred to in these notes recently, "The Ceylon Observer" commends editorially the views expressed in Professor Dash's article which appeared in this Journal last February on the need for research in connection with the live stock industry of the tropics. Sir Marcus Fernando is the principal mover in this matter in Ceylon, and public opinion appears to be strongly in favour of a special section of the Department of Agriculture being devoted to the improvement of cattle. According to Mr. William Smith, the Imperial Dairy Expert in India, the great need is fewer but more efficient cattle both for milking and for draft. The solution of the cattle problem in the tropics lies in the two ideas of fewer animals so as to reduce costs, and more efficient animals so as to increase returns. The dual purpose aspect is also essential, and Mr. Smith contends that it is an entirely mistaken notion that the two qualities cannot be combined together in one and the same herd. This point of view is indeed highly important and the measures taken in Ceylon in regard to the improvement of live stock will doubtless be followed with the greatest interest in all tropical countries.

POLYNESIA.

Dr. Casey Wood, of Chicago, who travelled through the West Indies in 1922 now sends us one of his long interesting letters dealing principally with observations on bird life, from Fiji. In this he describes the characteristics and habits of such interesting avian species as paraqueets, sunbirds, Fiji robins, honeyeaters, fantails and the albatross. The birds of the southern ocean possess wonderful powers of flight and this particularly applies to the wandering albatross. One of the most attractive species in the South Seas is the red-tailed tropic bird which derives its name from the bright crimson-red of his elongated and very attenuated retrices. But the chief glory of Fiji's avifauna are the Wild Fruit Pigeons and Doves. The Nutmeg Pigeon has iridescent wine-coloured plumage and a remarkable stomach lined with horny spines to grind off and pulpify the arillus or "mace" from the wild nutmegs on which it subsists. There is also the equally beautiful chili Pigeon which flourishes on red hot capsicums. Dr. Wood is a well-known observer in connection with the comparative psychology of birds and he holds some very interesting views in regard to the mentality of parrots. His present letter makes frequent reference to the bird mind, a subject which, though difficult, offers an extremely fascinating field for study. It is interesting to note in Dr. Wood's observations that there are few or no monkeys (or for that matter few other mammals) in Eastern Polynesia. Dr. Wood presumes that the earlier voyagers from the mainland had not learned to carry them as pets, like many other native tribes, on their long sea excursions, or they did not survive the exposure incident to canoe life. In any event, it is not until one reaches islands relatively near the Asiatic coast—Borneo, New Guinea, Java and the Celebes—that simian life becomes abundant.

MALAYA.

The distribution of Malayan trade last year shows that imports from Empire sources accounts for only 35 per cent. of the value of total imports (£67,072,040), and exports from British Malaya to the United Kingdom and other parts of the Empire to only 26 per cent. of the total value of exports (£77,878,265). The United States is Malaya's best customer for Malaya's principal exports rubber and tin, and the value of these commodities account for the greater part of the total value of exports (given above). The United States also imports considerable quantities of pepper, gum and gutta percha. As would be indicated by this, Malaya is in a very prosperous condition for even with rubber at 1*s.* 3*d.* the Companies can pay very handsome dividends as well as provide for substantial reserves. With tin at £250 per ton this country has a second substantial string, and it must not be forgotten that Malaya is also one of the largest exporters of copra. Singapore, her chief port, has received great prominence of late in connection with the proposed naval base. An enormous tonnage passes annually through Singapore and this port also does a great deal of transhipment for Java, Borneo and Sumatra.

KENYA.

Attention has recently been directed in an article by Mr. Barbe Baker to the large bamboo resources of this Colony and their possibilities for local pulp manufacture. The species is *Arundinaria alpina* which grows at an altitude ranging from 7,500 feet to 10,000 in gregarious communities covering in all, it is estimated, nearly a million acres. Some 80,000 acres of this is at present accessible and with future railway development larger tracts will be available for exploitation. Unlike the Indian bamboos which occur over similarly large areas, the Kenya species does not flower *en bloc* and consequently there is no periodical widespread decay of mature culms, which would be disastrous in respect of continuous factory supply. The average number of serviceable culms to be expected from the acre in Kenya is 4,500, while the useful length of the culms is about 50 feet with an average diameter of 2·5 inches. Three to five years is regarded by Mr. Baker as the economic period for felling, and laboratory experiments have given 37 per cent. of air dry pulp when this pulp has been treated with a solution of caustic soda. The pulp has bleached well in experiments and has yielded white paper of good quality. The yield, including loading and size was 41·23 per cent. of the weight of the bamboo. This result is regarded as satisfactory.

HAITI.

The Technical Bureau of the Department of Agriculture is now organized, with Dr. Geo. F. Freeman, as Director-General. An appropriation of $170,000 has been passed for the support of this work. This Bureau will organize a central institution for the preparation of technically trained men for government and other service, and of teachers for agricultural schools, will be provided with school gardens and will endeavour to ameliorate conditions in the rural districts by teaching the youth of the country better how to care for themselves, their crops and their domestic animals. There will be a central experiment station which will undertake work in the various phases of Haitian agriculture as well as serve as a laboratory field for the students of the central school. Branch experimental and demonstration farms will be organized in localities especially adapted to coffee, cattle, cotton production. Inspectors and advisers will be trained and sent into agricultural districts for the purpose of aiding the adult population with sound advice and leadership, and assisting them in the eradication or control of diseases and pests which may endanger their plants and animals. It is the purpose of this Bureau to aid in the marketing and development of markets for Haitian products, as well as the introduction of standard methods of packing and grading. The Bureau will also inaugurate work in forestry and forest products conservation, particularly that of valuable dye-woods and timber, the reafforestation of denuded mountain sides, and the protection of existing forests with especial reference to the protection of springs and natural water sources.

THE AMAZON.

The cruises up the Amazon which are now being advertised and have already achieved deserved popularity among tourists, are effected by ocean steamers of the Booth Line. The return journey from Liverpool to Manaos, 1,000 miles up the Amazon can be made in so short a time as six weeks at a cost of £90. Calls are made at Leixoes (for Oporto), Lisbon and Madeira. Manaos itself is the centre of the Brazilian rubber industry and lies in the heart of the forest region of tropical South America. The educative value of travelling by ocean liner one-third of the way across South America with the land in places almost out of sight, is in one sense considerable, and it is not impossible that these tours may lead to wonder and then suggestions for solving the great problem of developing the Amazon valley. At present, rubber, mostly wild rubber, is the principal export, and although the quantity has increased slightly during 1922 and 1923 there has been a big general falling off in both quantities and value in the last three years due to the depression. The figures are interesting. In 1916, the quantity of Brazilian rubber exported was 37,250 tons; in 1917 it was 38,900 tons; in 1918, 31,450 tons; in 1919, 34,815 tons; in 1920, 35,000 tons; in 1921, only 17,500 tons; in 1922, 22,296 tons; and in 1923, 21,400 tons. It would appear as if the Amazon will eventually need a new industry. Among the almost insurmountable difficulties at present is the sparsity of population for any industry that demands considerable labour. This was recently discovered at the Peruvian end by the American rubber-growing expedition which went to enquire into the possibility of establishing plantations.

ESTATE ACCOUNTANCY.

PROFESSOR W. R. DUNLOP.

[*The following article, the third of this series, deals very briefly with the questions of valuation and depreciation. In the first article the general nature and administrative aspects of accountancy were discussed, while in the second article attention was given to the nature of balance sheets and double-entry.*]

Importance of Valuation.—Before we can proceed from financial book-keeping to costs, or fully appreciate even the financial aspect, it will be necessary to consider the principles of valuation. There are few other aspects of accountancy on which opinions are found to differ so much. This is to be expected, perhaps, since the valuation of an estate can be regarded logically from more than one point of view.

Cost and Value.—If I buy an estate its value from the standpoint of my own personal responsibility is what it has cost. If, instead of retaining the property I place it on the market and sell it, the price obtained is its value on the market, or selling value, which becomes its cost value to the new purchaser. Generally speaking, one buys an estate, not as a merchant buys cotton piece goods to sell again as quickly as possible, but rather as a more or less permanent productive investment. One sets out to invest capital in a productive industry, and unless one takes as a basis the amount of capital actually invested, it will be impossible in course of time to say whether that capital might not have been more profitably sunk in other concerns. It does not matter to what extent the market price of the product which the estate produces varies, or to what extent the local rate of wages varies either—the initial capital cost remains an immutable fact. Low market prices and high wages of labour may ultimately render the estate valueless from the market or buyer's point of view, or conversely high prices and low wages may make its value correspondingly great. But from the owner's point of view its value to him, from the standpoint of management and responsibility is what it has cost. Furthermore the owner must know how his capital is apportioned in different departments and fields of his estate otherwise he will not be able to tell in what proportion each is responsible for interest on capital.

Establishing an Estate.—In establishing a new estate it is always customary to take this cost as a basis of value in the first instance. Later, however, there is a strong tendency amongst owners to adjust cost to market prices. From the management standpoint this is wrong. In the case of the 200-acre coconut estate Balance Sheet given in the previous article of this series, the assets are all assessed on a cost basis. The value of each field of coconuts comprises the cost of the land, clearing planting and bringing the trees up to that point of productivity when the sale of the produce is sufficient to cover the costs of reaping and marketing. At this point current expenditure on the trees begins and the estate becomes a "going concern." Improvement in the yielding capacity of the trees due to natural development increases revenue and the market value of the estate but it does not increase its cost value, which is kept constant year after year, *less* depreciation and other losses, and *plus* any additional capital expenditure that may be incurred as time goes on.

An Established Estate.—If an already established estate is purchased for say $60,000 this becomes its value to the new owner. In order to draw up a "statement of affairs" it becomes necessary to assign values to the various fixed, floating and liquid assets. This can be done by valuing the individual assets like buildings, machinery, land and trees at either their probable individual cost value or selling value to date. The percentage of each on the basis of this total is calculated and these percentage figures can then be used to divide up the actual cost price proportionately.

Interest on Capital.—H. C. Henricksen in a detailed contribution dealing with cost accountancy for fruit plantations in Porto Rico, allows the purchase price of land and annual expenses during the development stage to increase at compound interest. It would seem more desirable, however, not to include interest at all but to record merely the bare cost in establishing an estate. The interest is purely statistical. It does not represent an actual disbursement (assuming of course the capital belongs to the owner). Further, in subsequent discussions that might arise it will be necessary, if interest has been charged, to re-calculate costs and in all probability it will lead to controversy, one person saying that 3 per cent. should have been the interest charged and others 5 per cent. and so on. If we take the bare cost we reduce the capital correspondingly at the end of the development period and consequently raise the profit per cent. of capital. From this profit we can deduct statistically such interest as we think fit.

Capitalisation.—Estates are generally valued on this basis when placed on the market. An average profit say of $10,000 per annum is made and taking 20 per cent. as the normal average return for the class of estate in point, the capital value becomes $50,000. This form of valuation is based upon variables over which there is generally little control, such as the market price of the estate's produce and the rate of wages of labour. It involves mutual agreement between buyer and seller and this agreement frequently depends upon psychological circumstances and inside information. Previous earnings or losses however, are not necessarily indicative of an estate's value even as a "going concern." New management and a change in the "standards of production" *e.g.*, reduction of overhead charges by combining with other properties may turn a losing concern into one that pays handsomely.

Individual Fields.—It is now being widely recognised in tropical agriculture that it is essential to divide up the cultivated area of an estate into fields or sections. These will be found to have

entirely different costs and revenue earning values due to topography, location, soil fertility, prevalence of pests and diseases, &c., It is true that the differences will mostly have regard to current expenditure, but there will also be differences in respect of initial cost value, one field producing bearing trees earlier and therefore more cheaply than other fields. Since the soil and the plant are biologically one, it is always convenient and scientific, wherever possible, to consider each unit of soil, trees and atmosphere, as a single biological factory. It is no different to a mechanical factory except that in our present knowledge and application of physiology the biological factory is generally subject to greater variation.

Machinery and Buildings.—Cost valuation for the different items in each class should be kept separately so far as doing so serves a useful purpose. Coolie lines the depreciation of which is a legitimate debit to wages account, should be distinct and similarly overseer's house, manager's houses, and the main machinery units in the factory.

Live Stock.—In the case of a dairy herd Orwin considers that calves are a by-product and therefore have no value other than the cost of rearing. In the case of a breeding herd the cost value of the calves at birth is the cost of maintaining the herd. Subsequently the cost of such calves will increase with the cost of rearing. In the case of working cattle in the tropics calves at birth are of no value in cost accountancy.

Intermediates, Substitutes and By-products.—A field of green dressing is an intermediate. Its value must be assessed at what it has cost. The position when it serves the triple purpose of weed control, humus supply and a crop of seeds will be considered later under cost accountancy proper. A substitute is employed when purchased manure is used instead of home-produced manure. Adherence to cost values will be readily seen to be of importance here in order to determine which is the cheaper to supply. By-products normally, have no value in estate management except cost of handling, &c., after their separation. Examples of by-products are megass, exhausted molasses, cacao runnings and coconut shells. The items dealt with above frequently involve in respect of their valuation a great deal of thought and technical knowledge and it is not desirable that the rulings in this paragraph be accepted as final in all circumstances.

Depreciation.—Depreciation is the difference between original cost and residual value. Depreciation occurs universally on the estate except perhaps in regard to meteorological conditions and the soil. The soil if kept in "repair" has generally speaking an indefinite life. Depreciation is generally defined as the expiration of capital outlay from causes not under the practical control of man. A subsidiary definition and often a useful one is the provision to enable an owner to take a working asset out of commission when it becomes obsolescent, *i.e.*, before it reaches its residue or scrap value (or "bush" value in the case of economic vegetation). This often applies in the case of sugar machinery when the progress of science and art makes substitution of new patents economically advisable. It may also occur in the case of highly productive tree crops should for instance a new budded strain be invented. Therefore the rate of depreciation should always be too high rather than too low in order to encourage discarding for efficiency. Residual value, however, may be more than scrap or "bush" value to certain buyers with special requirements and ideas, even if market and cost values of the article are the same.

Determination of Rate.—The determination of the rate of depreciation necessitates a decision as to the effective life of an asset under proper care and maintenance. The cost value divided by the number of years gives in the case of cost accountancy the straight line or linear rate of depreciation. Depreciation is often charged however as a fixed percentage of diminishing value. This latter system makes the charges heaviest at first and then progressively lighter. In estate depreciation at least four special cases occur for consideration (*a*) buildings (*b*) machinery (*c*) trees (*d*) crop-ratoons.

Buildings.—As with all decisions as to depreciation, technical knowledge, common sense and circumstances must be brought to bear on the point at issue. Wooden buildings, if kept in good repair commonly have a very long life in the drier parts of the tropics—say 60 years. On the other hand in the Federated Malay States owing to white ants and other causes the life is very much less and higher charges for depreciation are necessary. Ten per cent. per annum is the usual charge against the users of buildings for depreciation. Frequently this is too high. Heavy expenditure on repairs may produce appreciation which is really capital expenditure in so far as it exceeds the rate of depreciation and maintenance.

Machinery.—In the case of sugar machinery the practice is sometimes followed of allocating from profits to a sinking fund for renewals. This is the same thing financially as charging depreciation against each piece of machinery provided the rates on which these allocations are based are not excessive. If they are excessive they cease to be true costings charges and become a provision for the future. Depreciation in regard to sugar machinery is exceedingly important but very difficult to generalise on. Depreciation policy in practice is often adjusted to fit the budget. It may be noted that depreciation of rollers in a mill depends upon quality, position, size of grooving and the work of the factory. The depreciation of such machinery as field tractors is difficult to assess in our present knowledge. In this and in many other estate properties definite investigation and careful records are necessary. It has been suggested that tractors may be depreciated on the basis of fuel consumption.

Trees.—Depreciation in a coconut tree is normally its cost up to the time it comes into commission divided by its length of useful life.

Our exact knowledge of the annual yield history of crop-trees is exceedingly scanty. If we take the effective life of a coconut tree at 100 years and its cost value at $5.00 (both rather high) we get an annual depreciation of 500/100 cents= 5 cents. But we know that yielding capacity increases slowly up to say 10 years and then increases rapidly up to say 30 after which there may be a steady decline for the rest of its life. It may be better therefore to write off depreciation in proportion to yielding capacity in order that the heaviest charges may fall in the period when they are most likely to be borne with least embarrassment. Depreciation in the coconut tree is due primarily to senile decay unvoidable disease and inimical factors of environment acting on the whole plant; in the case of cacao the depreciation is due mainly to senescence of the root system, for the aerial part of the plant can theoretically be suckered indefinitely. If a tree is prematurely killed by any cause the valuation of the field on which it grew must be written down by the amount which the dead tree cost to bring into bearing less its depreciation to date. Supplying another in its place is a charge on revenue. These are general principles in orchard management.

Ratoon Crops.—What is the valuation of a field of sugar cane stumps after the plant canes have been reaped, assuming that it is intended to carry on ratooning for five years, as is being done on "cacao land" in Trinidad to-day? Canes themselves are merely shoots or twigs. The cane stem and root system lie below the soil. Technical knowledge must be utilised in coming to any decisions as to estimates. The value of the field of stumps in the case under consideration is either the cost of the stumps or *nil*, according to our point of view. If we make the plant cane crop pay for all expenses then the field of stumps has no cost value. But we can, if we wish, regard the original cost of establishing the field of plant canes up to the point when it is ready to be cut, as capital expenditure. Then the annual depreciation will be $\frac{1}{5}$ of the capital. The charges of the capital against the crops may be proportionately deferred so that the expenditure vanishes at the end of the fifth year.

(*To be continued.*)

THE BRUSSELS CONFERENCE.

The Sixth International Exhibition of Rubber and Tropical Products was carried through with great success at Brussels in April, and since the Exhibition included a conference of specialists connected with the rubber industry, a brief summary of the papers read in respect of planting aspects are likely to prove of interest to many readers of this journal. For the information abstracted we are indebted to the admirable report on the Conference which has appeared in the "India Rubber Journal" for April 12 and 19.

In dealing with the subject of labour forces on rubber estates, Mr. N. C. S. Bosanquet expressed the belief that if the policy of a survival of the fittest among rubber producers should ever be tried, the most economical working would be shown by estates with fixed residential labour wherever the property might be situated. In considering production costs, Mr. Bosanquet pointed out that the fact is also often overlooked that cheap working depends more upon regular labour and work being kept up-to-date than upon whether a coolie is paid 40 or 37 cents a day. He was also of opinion that the giving of head money to Kanganies in Ceylon and the F.M.S. and especially the policy of using children in the fields was of the utmost importance. The last-named practice had much to do with the efficiency of the Tamil coolie in Ceylon as he was trained as a child and gradually became expert in all departments of estate work.

Dealing with the present and future problem of the plantation rubber industry, Mr. P. J. Burgess (Chairman of the R. G. A.) felt that one of the biggest problems for solution was the reorganization of rubber growers in such a way as to avoid the present dissipation of strength by sub-division of units, and to put the industry into such condition that it could as a single unit, or as a very few units, deal with matters such as price, propaganda and production on a comprehensive scale in the interests of all producers. He showed that there were tendencies in this direction. To obtain co-operation between producers and manufacturers has been the aim of rubber growers, said Mr. Burgess, for some time past, but up to the present without much success.

Professor V. H. Blackman, Sc.D., F.R.S., read a paper on physiological aspects of plant diseases. Calling attention to the fact that the effect of unfavourable environmental conditions—unsuitable temperature, drought, water logging of soil—may produce a diseased condition facilitating the invasion by a foreign organism, he added that the "brown bast" of Hevea was probably in this class, the unfavourable environment being, apparently, too frequent tapping.

On the subject of weeding Mr. Noel Bingely advocated selected weeding as opposed to clean weeding, and advised the cultivation of cover crops wherever practicable. By select weeding is meant the regular eradication with the fork of all harmful weeds, and especially of all lalang and other grasses which appear sporadically, but can be reduced to a negligible minimum by a systematic and regular removal as soon as they show themselves. He realised that planters in Ceylon generally favoured clean weeding and although the condition of most estates in Ceylon form excellent testimony he nevertheless considered selected weeding in most countries a necessity for reasons of economy.

An important paper was read by Mr. J. G. Hay on accountancy and costing in the rubber planting industry. After mentioning that the practical and effective costing system had been employed in the

rubber industry since its commencement, Mr. Hay added that one of the rewards had been that the system had enabled substantial economies being effected during the depression of a few years ago. In regard to the apportionment of indirect expenditure or "general charges," Mr. Hay said that two methods most commonly in use were (1) apportionment on basis of wages, and (2) apportionment on basis of acreage, and expressed the opinion that the second course provided a sounder basis as many items included in "general charges" had little or no relation to wages. After referring to administrative charges against capital on account of immature areas, Mr. Hay said a safe rule was to make no charge to capital if it would have been equally incurred had there been no immature area. The important matter of "all-in" costs was dealt with in this paper, and it was pointed out that until producers were agreed upon a common formula for calculating "all-in" costs, a comparison of costs as between companies and estates were bound to be misleading unless made by competent authorities who had intimate inside knowledge of the methods of calculation. Presented with this interesting paper was a complete set of estimate forms for use by estate managers and illustrating general practice in the industry.

Concerning tapping systems on the east coast of Sumatra, Mr. J. G. J. A. Maas concluded from the study of results obtained by the A.V.R.O.S. that periodical tapping enables the grower to obtain the same yield at lower costs than with daily tapping, to obtain a longer period for bark renewal with loss of yield; and to increase this period for barkrenewal at every cycle of tapping without being obliged to tap at too great a height from the ground.

In a paper on the adjustment of production and consumption Mr. H. Eric Miller referred to the labour aspect and pointed out that the high expense of recruitment from Southern India which forms so striking a feature of plantation industries in the F.M.S. and Ceylon would be entirely wasted if the labour had to be disbanded. He added that casual labour is of very little value to a rubber estate. It was clear from the remainder of Mr. Miller's remarks that, owing to the world's potential rubber productive capacity being this year 500,000 tons, over-production would immediately ensue if restriction were abolished.

Dr. H. P. Stevens communicated his views on sprayed rubber latex—a subject on which he has recently written a great deal. While admitting that sprayed latex vulcanises more quickly than plantation rubber, and that it has been found to age better also, he nevertheless regarded these qualities as being probably due to the protective action of serum substances retained.

Of considerable scientific interest was Dr. O. de Vries' paper on the rôle of enzymes in the coagulation of Hevea latex. Dr. Vries regards the views of many writers on the importance of a coagulating enzyme as inconclusive. Apparently the action of enzymes is to be regarded as auxiliary to chemical coagulents instead of as some technologists think, the reverse. It is extremely interesting to note that although the power of the enzyme present in Hevea latex is limited, there are other enzymes which are true coagulating enzymes and might be used for the coagulation of latex in practice. Papain, for instance is able to coagulate Hevea latex without the aid of a coagulant.

Concerning education Professor J. B. Farmer read a paper on the training of scientific officers for tropical plantation industry. Professor Farmer's opinion was to the effect that different classes of officers should be utilised by estates: (*a*) purely scientific officers mainly engage in research; (*b*) men of scientific training and outlook whose main object is to disseminate information and give advice; and (*c*) agricultural scientific officers, who should have had training in the principles of agriculture as practised in the fields, in addition to a thorough scientific training, at least up to the standard of a high honours degree at a University. For agricultural scientific officers, the (*c*) class, Professor Farmer considered such officers need training in the principles of agricultural science as well as in the practice of agricultural art if they are to succeed in administrative and advisory work.

METEOROLOGICAL.

Value of Lightning-Rods.—The approach of the warm season in the Caribbean region heralds not only the possibility of hurricanes but also the certainty of thunderstorms and lightning. The damage caused by lightning must be considerable throughout the tropics. In Jamaica and British Honduras—particularly the latter—managers of coconut plantations report very considerable losses through trees being struck by lightning. Whether it would prove practicable to erect lightning-rods on coconut trees is an engineering economic question. As to the effectiveness of lightning-rods there is no question at all. J. W. Smith in his work "Agricultural Meteorology" shows that the efficacy of lightning-rods in the United States in the protection of farm buildings is over 90 per cent. But to obtain this efficiency certain conditions are essential: (*a*) the conductor must be *continuous*; from the highest points of the structure it is intended to protect, down to earth there must be no poor or broken points or rusted or broken connections; (*b*) there must be two "grounds," that is the rod point on the roof must project from a circuit, and it is also essential that the two "grounds" should be imbedded in *moist* earth even if it be necessary to go many feet below the surface of the ground. The rods may be of iron or copper—for general purposes iron is the better if protected from rust. If the rod is on a building and the building has an exposed telephone wire the conductor should be arranged to pass fairly close to the wire but well away from gas and drain pipes, &c., in or on the building. As regards losses amongst cattle as the result of lightning, there appear to occur mainly in the proximity of wire fences. Danger may be reduced by grounding wire fences at suitable distances. The electrical continuity of the fence should be broken at intervals, also, by inserting sections of non-conducting wood in place of the fence wire.

THE COLLECTING OF BALATA.

[*A former collector of Balata on the Delta of the Orinoco has furnished information based on his experience which, together with additional facts obtained from other sources, constitutes the substance of the following article.*]

The first move to be made in attempting to enter into the business of tapping balata in Venezuela is to obtain a licensed concession. This may be accomplished through various channels, and if it can be arranged it is best to pay down a lump sum say $3,000 for the right to work say 500 acres, this expenditure being demanded by the Government. In starting active operations, capital to the extent of two or three thousand dollars is needed in order to pay for equipment, stores and labour. If the concessionaire is also the contractor, that is the person in charge of the actual exploitation of the trees, he engages a sufficient number of Indians, say 100 for 500 acres, whom he will probably agree to pay ten to twenty cents at the present time for every pound of balata which they obtain from the trees. In the forest, the contractor and the Indians camp out under the usual tropical bush conditions and the Indians purchased food may cost 80 cents per head per day. In addition the Indians and the contractor secure a great deal of game in the forest and fish from the rivers. In fact at least four men are told off each day to hunt and fish respectively, and their bags and catches constitute a valuable and acceptable addition to the winnings of the expedition. The purchased food for the labourers consists of flour, rice, cheese, sugar, corn and last, but not least, rum.

In Venezuela until quite recently balata exploitation has been a most destructive industry for the trees instead of being tapped alive have been cut down first. It is estimated that in the ten years preceding 1918 thirty-six million trees were destroyed. Although the destruction of trees is and has for years been prohibited in British and Dutch Guiana (which together with Panama are other principal sources of balata supply) this conservative policy has been obstinately opposed in Venezuela. The collection of the balata takes place from May to August and the average yield of latex per tree in Venezuela is about three gallons, equivalent to 18 lbs. of balata which at present is selling in New York at about 65 cents per lb. on the spot. One of the greatest expenses in the quest for balata is the transport and it is reported that the cost of getting balata out from inaccessible places is over 10 cents per lb.

The grades of balata differ widely, the best being Sheet Balata and the second grade Block Balata. Again Block Balata may vary considerably especially on account of careless preparation of the latex and adulteration which is sometimes deliberate. Taking Block Balata first the most essential thing is the thorough kneading of the coagulated latex at the camp in order to remove air pockets. Care has to be taken also both in regard to the prevention and detection of adulteration. But if adulterated, balata can be washed and the adulterants separated out. Sheet Balata, which fetches the highest price on the market is made from the liquid latex by the drying effect of the sun. The latex is run into large trays which have an adjustable lean-back hood something like that of a buggy or carriage to collect the radiant energy. Thin layers of pure balata are peeled off as the surface drys. This Sheet Balata contains fifty per cent. of its weight of pure rubber substance and no dirt.

As regards the trees themselves it may be mentioned that the species which produces the true balata of Venezuela and the Guianas is *Mimusops globosa*. This tree is to some extent gregarious and may grow to a height of over sixty feet which the tappers have to climb, for the tapping is usually done at the top. The tree does not regenerate easily one reason being that animals eat the fruit and seed. The wood of this tree is exceedingly hard and is commercially employed for piles in fresh water and for railway sleepers.

Although the term balata has been used in reference to rubber-like products from Eastern countries and West Africa, true balata production is almost solely confined to tropical America. In technical works balata is described as a substitute for gutta percha and it is interesting to remember that the sources of both of these are trees belonging to the same natural order, Sapotaceae. But the botanical sources of gutta percha are species of the genera Palaquium and Payena, natives to the Malay States and cultivated both there and in Java though they were formerly merely subjects of exploitation. The best gutta percha commands a higher price than balata, but it is difficult to say which is of the higher economic value. In Malaya and Java large company interests own gutta percha plantations and the question arises whether similar developments could not be carried out in British Guiana and in islands like Dominica which possess a moist climate, in regard to balata. Mr. Davies of Messrs. Rowntrees has given careful thought to the possibility of developing balata plantations on part of the Company's Dominica property, and the opinion of the Trinidad Conservator of Forests is not in opposition to the possibility of achieving success in this direction. On account of the long time which balata takes to mature the planting of these trees is not an attractive investment for the private individual. But there is no doubt that Colonial Governments might give attention to the planting of balata especially in mountainous districts having good soil and heavy rainfall. Such an investment would tend to strengthen the credit of the Colony concerned, and furnish in time a productive industry which could either be sold or be operated to increase the State revenue.

The output of balata from British Guiana generally moves around an average of some seven hundred tons per annum while in Venezuela the output is around one thousand tons. The production of balata varies greatly according to outlook in respect of market prices, but there is no doubt that with balata at three shillings a

pound a well-stocked concession not too far from port which can be reached by donkey to the river bank and then by dug-out, would constitute a very profitable industry and in many respects an exceedingly sporting one.

COLLEGE NEWS.

Sir Francis Watts will retire from the position of Principal and Imperial Commissioner of Agriculture at the end of this Session after nearly forty years of strenuous work in connection with West Indian agriculture. It is the hope of all at the College that the retirement of Sir Francis will not mean a complete cessation of his many activities in the interests of tropical agriculture.

The First and Second year Diploma Examinations are being held at the College from June 16 to 28 subsequent to the end of the present Session and the beginning of the summer vacation which extends from June 28 to October 1.

Professor Ballou returned to Trinidad after an official visit to the Leeward Islands on May 22.

Professor Ashby sailed for England on June 10 to attend the Botanical Conference in London.

The Secretary of State for the Colonies has informed the Principal that certain officers selected for the Gold Coast Department of Agriculture will in future be sent to the College from England for a course of training before proceeding to Africa to take up their substantive appointments.

Messrs. N. S. Haig, B.Sc., J. C. Hopkins, B.Sc., and A. B. Killick, B.Sc. (post-graduate students) have received appointments under the Empire Cotton Growing Corporation to positions in Uganda where they will be attached to the Government for work in connection with cotton. They will leave Trinidad for England on July 1 and will proceed to East Africa at about the end of August.

The Empire Cotton Growing Corporation has appointed Mr. G. W. Nye, B.Sc., to the position of Assistant Cotton Specialist in Nyasaland. Mr. Nye will leave Trinidad for England on July 1 and will proceed to Nyasaland about the middle of September.

Mr. G. R. Frecheville, B.A. (post-graduate) sailed for England on June 26 for the vacation, and Mr. R. Parga, B.A. (post-graduate) leaves on July 1.

Mr. R. G. W. Farnell, A.I.C., Chemist, British Empire Research Association who left College for England in January last, has written from London saying that he expected to leave for Durban, Natal, on May 22.

Continued progress is to be reported in regard to the circulation of the College journal. Through the courtesy of Directors of Agriculture copies have been specially distributed in most of the British Colonies and Protectorates and in India, while many of the British Steamship Companies serving the tropics have kindly agreed to place copies of each issue in the libraries of their ships before sailing from England. In Hawaii, through the kindness of the Director of the Experiment Station of the Hawaiian Sugar Planters' Association (Dr. H. P. Agee) copies have been circulated to each of the local agents for the Hawaiian Sugar Plantations and similar services have been rendered in many foreign countries by H. Britannic M. Consuls. Opportunity should be taken here of recording the College's appreciation of the above services in helping to disseminate its teachings, aims and researches.

With the almost completed and imposing edifice of the new College building, and the steel framework of the sugar factory in erection behind the present long range of laboratories and offices and the well-kept banana-variety fields and plant-breeding grounds between, the College is rapidly becoming a striking and attractive spectacle accentuated by the spacious surroundings of park-like savannah and grazing cattle, overlooked by the northern range of forest-clad hills enveloped in brilliant sunshine.

The College tennis tournament which started in April finished towards the middle of May. The finals resulted as follows :—*Singles :* H. C. Vilain beat T. B. R. Bovell 6-3, 8-6 : *Doubles :* H. C. Vilain and J. C. Hopkins beat S. H. Evelyn and A. B. Killick 8-6, 8-6.

A new tournament is now being played off between the Post-graduates and the Diploma students. The results will be published next issue.

THE COLLEGE AND TYPES OF INTELLIGENCE :— The important point to realise from the educational aspect is that intelligence whether it be considered within or outside of the College, is of at least three distinct psychological types. There is Abstract Intelligence or the ability to deal successfully with symbols, as in mathematics or writing ; Mechanical Intelligence or the ability to deal successfully with machinery ; and Social Intelligence or the ability to deal successfully with people. These three types are now definitely recognised in psychology and have nothing to do with "knowledge" *per se* : they are types of *ability*. One of the difficulties attendant on agricultural education is that agricultural pursuits not only involve the application of these three types, but also probably a fourth and hitherto inadequately unrecognised type namely Biological Intelligence or the ability to deal successfully with plants and animals.

It is with Social Intelligence that we ought to be concerned, and with its development, not only within, but also outside of the College. This type of intelligence aims at inculcating a fairly normal emotional state, ability to make ethical discriminations, to take an interest in others, and to form proper moral concepts. These are just as necessary for success and happiness in agriculture and industry generally, as the possession of a fair degree of abstract, biological or mechanical intelligence.

TREND OF THE MARKETS.

(*The notes below are based principally upon running charts of the prices of the basic grades and upon general statistical information gleaned from contemporary publications and cablegrams and are intended to be a record of movements. An attempt is made, where possible, to indicate the market outlook at the time of going to press, but no responsibility for the accuracy and subsequent truth of such observations is assumed. Unless otherwise stated the prices quoted are spot, London*).

SUGAR.—Since the third week in March there has been a steady decline in values but a slight revival in the middle of May when on the 16th Cubas were quoted at 5·48 duty paid, New York. The British Government's attitude in regard to Preference is a cause of uneasiness amongst Empire producers.

COTTON.—The value of fully Middling Upland at Liverpool fell from 19*d*. in the second week of April down to 17*d*. per lb. at the end of the first week in May. There were subsequently slight advances.

CACAO.—A further decline in Trinidad cacao is to be recorded for May, value 9½ cents New York. Accra and Trinidad price movements have been similar. U.S.A. manufacturers appear to be out of the market for Trinidad.

COFFEE.—After reaching the high level of 96*s*. per cwt. on March 19 the price of Santos has been steady at 94*s*. 6*d*. up to the first week in May. Other grades including Costa Rican have shown a sharp decline. Rio 7's (New York) 15 cents per lb. and Santos 4's 18¾ cents (New York).

TEA.—The Indian average declined towards the end of April to 17*d*. per lb.

SISAL.—Prime sisal has continued buoyant reaching £47 10*s*. a ton on May 1. Manila hemp at the same date was £39 10*s*.

RUBBER.—Values of plantation crepe to which figures in this section refer, reached their lowest level on March 26 (1*s*. per lb.) but have since strengthened to 1*s*. 1*d*. (May 1).

RICE.—The value of Burmese has been steady around £16 5*s*. per ton.

COPRA.—From £29 per ton for prime grades in mid-April copra has shown a firmer tendency, f.a.q. Ceylon being quoted at £29 10*s*. per ton (May 1).

VEGETABLE OILS.—Most items in this market were decidedly quiet at the end of April and beginning of May. Coconut oil was very dull, Ceylon c.i.f. 44*s*.; crude cotton seed oil, 42*s*. 6*d*.; palm oil, Lagos, 37*s*., Softs 36*s*. 3*d*., Hards 36*s*. 9*d*.

CITRUS PRODUCTS.—Distilled lime oil was sold at $1.00 per lb. in New York in the middle of April with prospects of advancement of five cents on this price. Expressed lime oil $1.75 per lb. *ex* Dock New York. Concentrated lime juice has been steady but quiet at nominal quotation of £23 per pipes less 2½ per cent. f.o.b. car, New York.

SPICES.—Recent arrivals of African and Cochin have weakened spot prices in New York and though Jamaica qualities are limited buyers have not stocked ahead. Ordinary ginger 30 cents duty paid.

PINEAPPLES.—In view of the article in this issue on the production of pineapples the following London values for April may be of interest:—*South African*—"Ship" (22's Sliced) 16*s*., (2½'s Chunks) 16*s*., (1's tall, Sliced) 9*s*., (2½ Grated 11*s*.,) (1 tall) 6*s*. 6*d*., *Hawaiian*. (Extras, 24/2½'s Sliced) 19*s*., (Segments 24/2½'s) 17*s*., (Grated, 48/1's flat) 5*s*. 6*d*.; *Singapore*: (Full Size Chunks 24/3's) 16*s*. (Small Chunks 48/1½'s) 7*s*. 6*d*. (Sliced 48/1½'s) 7*s*.

Messrs. Gillespie Bros. & Co., of London write:—"The anxiously awaited statement of the Chancellor of the Exchequer was made in the House of Commons on the 29th instant and though disappointing to some interest seems on the whole to have been well received. Here we need only mention such items as affect the produce markets and the outstanding proposals are reductions in the duties on sugar, raw cacao, and coffee of 1½*d*. per lb., and on tea of 4*d*. per lb. These concessions are estimated to cost the country £24,000,000: on the other hand the producers of these commodities may be expected to reap the benefit of increased consumption.

"The rebate of 1/6th of the Duty on Empire-grown produce is to remain for the present; though it was not stated whether the proposal of the late Government to stabilise the existing preference of 4/3*d*. per cwt. in the case of sugar will be satisfied and this seems doubtful."

Concerning Rice, Messrs. Huth Gillespie of New York write: "The market maintains its firm position and news from the Orient indicates that both Siam and Saigon are scarce and likely to go higher in price. The domestic market also continues strong, although the demand is not quite as active as it has been during the past two weeks.

"Our market for Hides has continued in a depressed condition all this month. The buyers here will not take on stocks unless at extreme concessions. It appears that importations of leather (which are free of duty) from countries where labour is cheap have seriously affected the tanneries here. They state that until this condition is remedied they will not be able to operate their plants on full time. Under the circumstances this market will probably continue dull, unless the European buyers come in for supplies."

Tin has continued to command prices which have stimulated production, and there has been considerable activity in the mining districts. The year 1923 saw the largest export from Nigeria of palm kernels on record—namely, 223,000 tons. The export of palm oil for the same period was just under 99,000 tons, which is practically also equal to "record" figures.